



CALTRANS SUBREGIONAL OPERATIONS FORUMS

Performance Management





Why Do Performance Measurement? (FHWA Perspective)

- ▶ Provide the most efficient investment of Federal transportation funds
- ▶ Refocus on national transportation goals
- ▶ Increase accountability and transparency
- ▶ Improve decision-making through performance-based planning and programming



Why Do Performance Measurement? (Internal Story)

- ▶ How will we get better? How do we compare?
- ▶ Allows operations to compete in idea marketplace
- ▶ Similar to other data intensive programs
- ▶ Tell a good story for budget justification
 - ↳ % of pavements in Good or better
 - ↳ # of structurally deficient bridges
 - ↳ # of operating dynamic message signs....detectors
...signals...
- ▶ **Inform operations priorities**



MAP-21 Staged Rulemaking

NPRM DATE	MEASURE CATEGORY
STATUS I NPRM 1Q '14 Final 1Q '16	✓ Serious Injuries per VMT
	✓ Fatalities per VMT
	✓ Number of Serious Injuries
	✓ Number of Fatalities
STATUS II NPRM 1Q '15 Final 2Q '16	✓ Pavement Condition on the Interstates
	✓ Pavement Condition on the Non-Interstate NHS
	✓ Bridge Condition on NHS
STATUS III NPRM 1Q '16 Final May 2017	• Traffic Congestion
	• On-road mobile source emissions*
	• Freight Movement
	• Performance of Interstate System
	• Performance of Non-Interstate NHS

Then, effective date, targets and reporting.



Relevant MAP 21 Measures

Interstate Travel Time Reliability Measure	% of person-miles traveled on the Interstate that are reliable
Non-Interstate Travel Time Reliability Measure	% of person-miles traveled on the non-Interstate NHS that are reliable
Peak Hour Excessive Delay	Annual hours of peak hour excessive delay per capita
Non-Single Occupancy Vehicle Travel	% of non-single occupancy vehicle travel
GHG	Still delayed
Freight Reliability Measure	Truck travel time reliability index

How are agencies here responding to MAP-21 requirements?

Who is responsible?

Is there a plan?





What are some other Transportation System Performance Measures?





Types of Measures

Outcome

- ▶ Safety
- ▶ Delay
- ▶ Reliability
- ▶ Incident response
- ▶ Incident duration
- ▶ Mode shift
- ▶ Person throughput
- ▶ Cost savings

Activity (output)

- ▶ Traffic volumes
- ▶ Person/vehicle throughput
- ▶ 511 calls
- ▶ Web site visits
- ▶ Incident clearance time
- ▶ Number of trainings attended
- ▶ Number of projects brought in on schedule
- ▶ Quantity of ITS devices



But what about other important measures?

- ▶ Work zones
- ▶ Planned special events
- ▶ Responses to weather conditions
- ▶ Device reliability
- ▶ Customer satisfaction



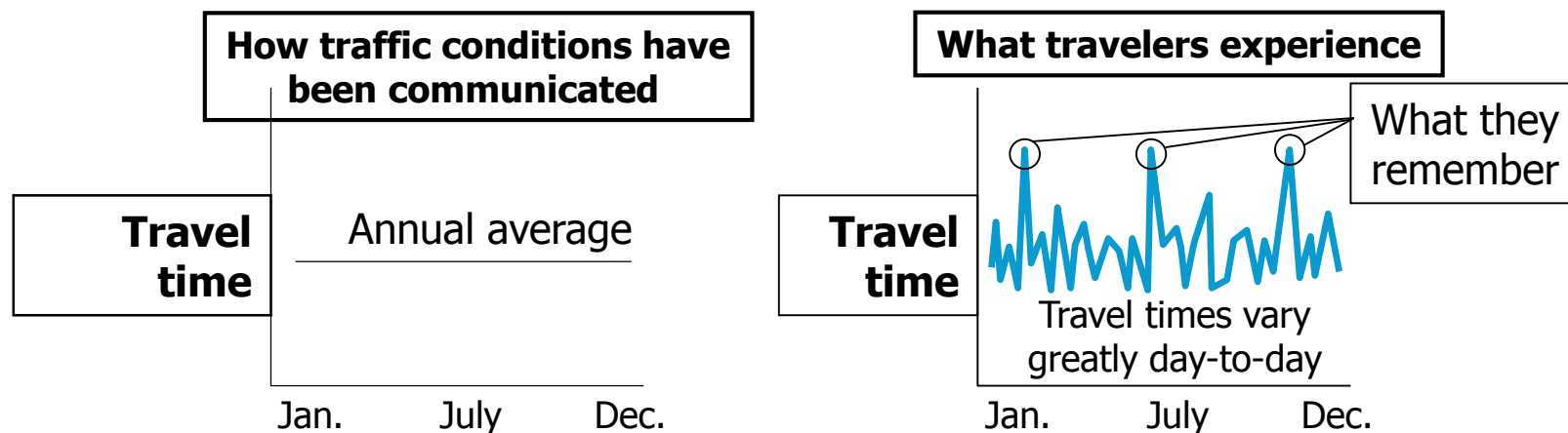


Why Is Reliability Important?

- ▶ Less tolerance for unexpected delay
- ▶ Travelers are familiar with routes they travel often
- ▶ Planning for unreliable travel has costs for users – late & early arrivals!
- ▶ Economic competitiveness
- ▶ Valued service in other utilities & industries
 - ↳ Deliveries (FedEx, UPS)
 - ↳ Freight/goods movement



Averages Don't Tell the Full Story



When MnDOT's ramp meters were turned off in 2000:



22 percent
worse
average travel
times

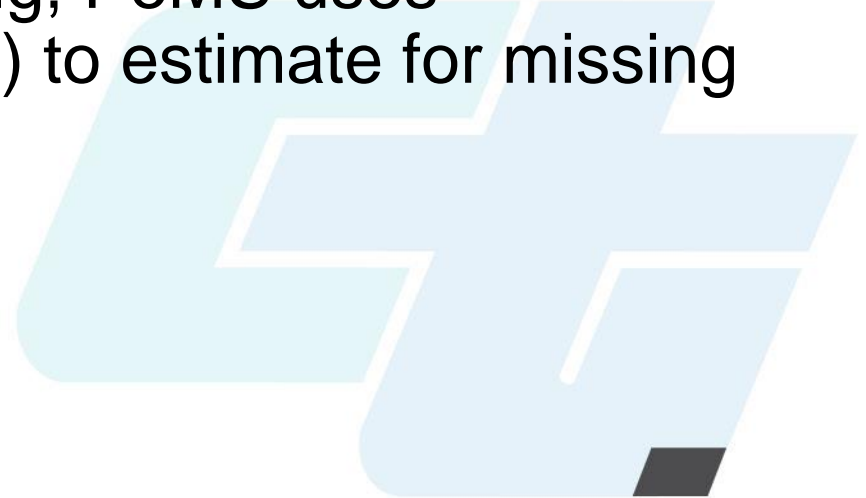


91 percent
worse
travel time
reliability



Caltrans Freeway Performance Measurement System (PeMS)

- ▶ Based on Vehicle Detection Stations (VDS) – sensors (mostly inductive loops imbedded in pavement)
- ▶ Algorithms allow for various performance measurements
- ▶ When sensors are not working, PeMS uses imputation (e.g., interpolation) to estimate for missing data





Corridor Perf. Meas. using PeMS

► **System Management Performance Measurement**

- ↳ Ramp metering (balance and optimize metering rates)
- ↳ HOV/Managed lanes (manage effectiveness and violations)
- ↳ Ramp intersection traffic signals (efficient control of flows)
- ↳ Integrated Corridor Management (ICM for all transportation)

► **Corridor Monitoring Performance Measurement**

- ↳ Demand (VMT) and throughput (flows or volume rates)
- ↳ Congestion (VHT, delays, peak periods, queue lengths)
- ↳ Bottlenecks (capacities, flow against capacities)
- ↳ Travel (travel times)

► **Incident Management Performance Measurement**

- ↳ Reliability (travel time variability, buffer or planning time index)
- ↳ Non-recurrent congestion (delay, duration, queue lengths)
- ↳ Incident and collision locations and frequency



Examples of Performance Reports

...and how other agencies use performance data
to build the case for supporting TSMO

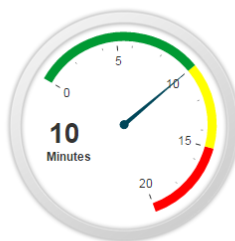




▶ GDOT HERO Incident Response Times

▶ Explaining Agency Performance

Average HERO Response Time



Description

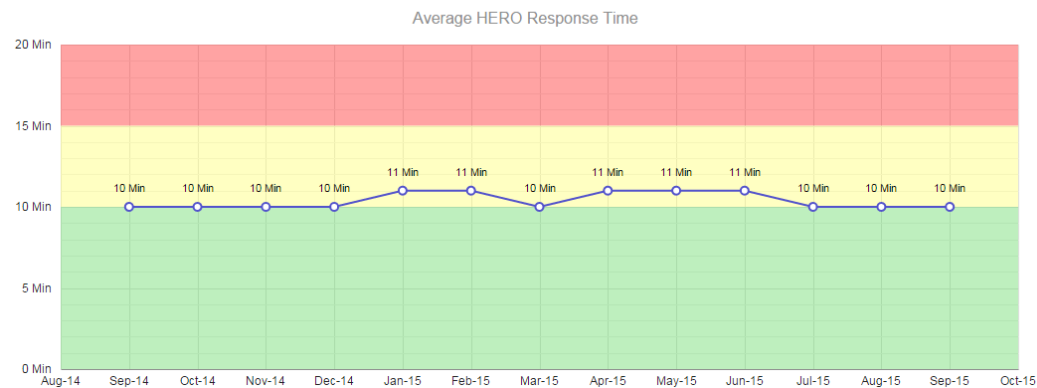
A roadway incident can delay traffic and present a hazard to travelers. By clearing a blocked lane one minute sooner, we could save our traveling public 4 to 6 minutes of delay. This measure tracks the time it takes a HERO unit to reach the scene from the time of notification.

Strategic Objective

Reduce the time that the traveling public is impeded by incidents. The target is to reduce incident response time to 10 minutes or less.

Road to Improvement

GDOT is exploring options to add additional HEROs to corridors with the highest incident rates. In addition, the new Automated Location and Dispatch System (ALADS) allows operators at the TMC to see the exact HERO truck locations on a map. This helps ensure that the closest HERO is dispatched to an incident; thereby further reducing response times. The average response time for FY 2014 was 13 minutes.



WSDOT's *Gray Notebook*

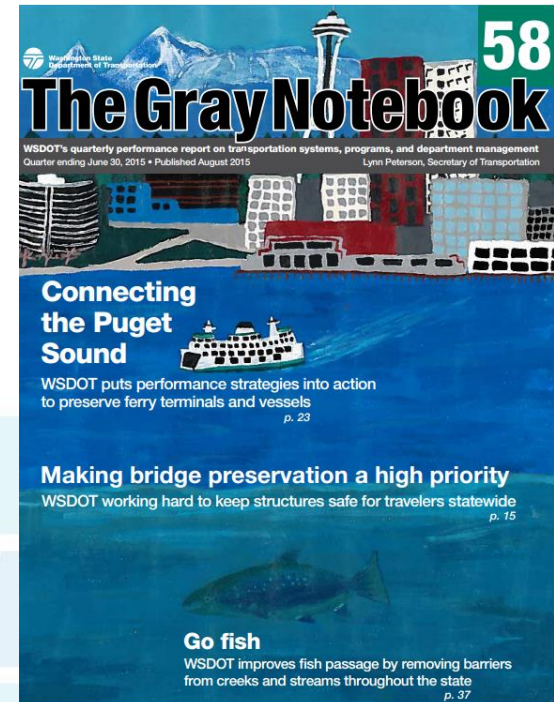
► WSDOT's Strategic Approach since April 2001

- ↳ Accountability & Transparency
- ↳ Comprehensive Performance Analysis and Reporting
- ↳ Adaptive and Dynamic Performance Measurement

► Communicating Two Simple Themes:

- ↳ Accountability
- ↳ Project Delivery

<http://www.wsdot.wa.gov/accountability/>



Wisconsin DOT

- ▶ Reliability and Delay Report
- ▶ Part of Five Key Goals for the Department
- ▶ Efficiency, cost, and trending improvements
- ▶ Delay, Reliability, Incident Response
- ▶ <http://wisconsindot.gov/Pages/about-wisdot/performance/mapss/goalmobility.aspx>

Wisconsin Department of Transportation Travel Time Reliability and Delay Report

Fall 2015



Travel Time Reliability

The Wisconsin Department of Transportation wants travelers to arrive safely and on-time at their destinations. Having a high level of confidence and certainty of on-time arrival are measures of the reliability of the transportation system.

How do we measure travel reliability?

GOAL:
Improve the reliability of highway travel

Because system reliability is important to so many individuals and businesses, WisDOT developed a travel time reliability performance measure as part of its MAPSS Performance Improvement Program. The statewide travel time reliability performance (PTI) measure tracks the reliability of ten Interstate corridors and 28 urban freeway and highway segments. This provides a precise way to budget travel time and measure system performance.

Planning Time Index (PTI) value

1.0-1.30 reliable
1.31-1.80 moderately unreliable
1.81-3.0 unreliable

To calculate reliability, the department developed a Planning Time Index that gives a numerical value for travel reliability.

WisDOT tracks ten Interstate corridors and 28 urban freeway and highway segments

Sample travel scenario

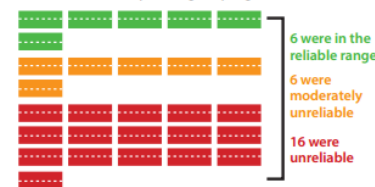
20 minutes
x 1.5 PTI
= 30 minutes

A PTI of 1.5 means travel is moderately unreliable. A traveler going for a 20 minute trip during a peak period would be assured of completing the trip in 30 minutes or less at least 95 percent of the time.



2014 Fall Quarter

For 28 urban freeway and highway segments:



2015 Fall Quarter

For 28 urban freeway and highway segments:



Efforts to improve

Many things can adversely affect travel time reliability, including traffic incidents, weather, special events, holiday traffic and work zones. Reducing or mitigating the impact of these factors serves to improve travel time reliability. The department is working to improve traffic signal systems, ramp meters, maintenance and work zone management to reduce traffic congestion. As part of the Zoo Interchange reconstruction in southeast Wisconsin, an integrated corridor management system is in place to improve traffic flow during construction. Travelers can also get real-time traffic information from the 511 Traveler Information System and choose to avoid congested routes. Some travelers are willing to accept delay as long as reliable information is available about the length of the delay.



Houston SAFEClear Rapid Towing Response

- ▶ Response time holds towing companies responsible (90% within 6 minutes)
- ▶ Clearance time & crash reduction used to justify City expenditures (10% crash reduction)
- ▶ Reduction in secondary crashes an important component of public support
- ▶ \$5M program => \$30+M crash reduction





The Operations Performance Measurement Plan

- ▶ Fewer measures are better
 - ↳ “Measure like you mean it”
- ▶ Choose measures that are understandable to intended audience
 - ↳ Internal staff and bosses
 - ↳ General public & decision makers
- ▶ Get started now, use current data and I.T.
- ▶ Focus on known and big problems; estimate the rest



Lessons for Plan Development: Getting Started

- ▶ Get the key people involved from the start and keep them “in the loop”
 - ↳ Includes senior-level people involved in transportation planning and programming
- ▶ Allocate plenty of time for developing consensus goals
 - ↳ Write a memo – spend 2 years implementing
 - ↳ ...or, spend 6 months gaining consensus, implement along the way



Key Considerations

- ▶ What are the most important stories?
 - ↳ What do the audiences need to know?
- ▶ How do the measures connect with the likely decisions and investment options?
- ▶ What are the most important measures? (Recognizing there will be many measures).
- ▶ Where does the data come from?
- ▶ What is the “ask”? (“what they do after they hear you”)



Resources



Operations Performance Measures: Resources

- ▶ FHWA Operations Performance Measures Website
 - ↳ Urban Congestion Reports (quarterly and annual), Program Examples
 - ↳ http://www.ops.fhwa.dot.gov/perf_measurement/index.htm
- ▶ Other Sources
 - ↳ AASHTO Standing Committee on Performance Measures
 - ↳ TRB Performance Measurement Committee
 - ↳ I-95 Corridor Coalition Probe Vehicle Data Project/Performance Measures Project



Travel Time (*Quality*)

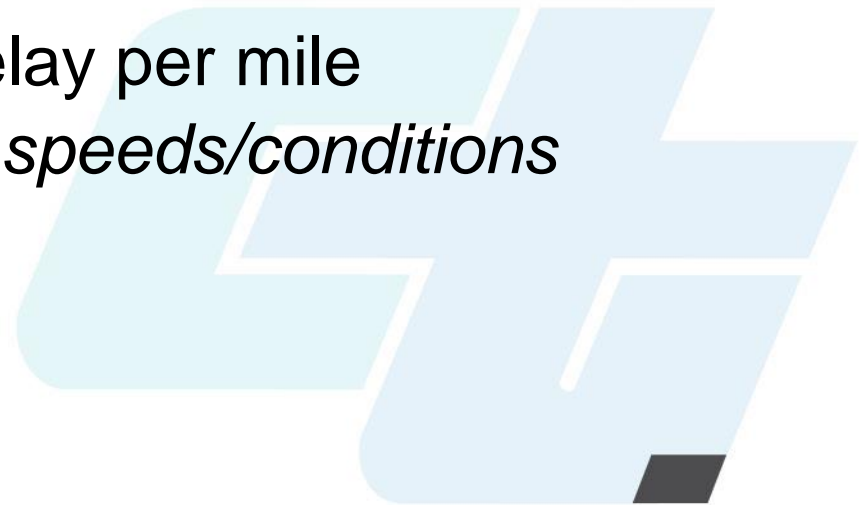
- ▶ The average time required to traverse a section of roadway in a single direction
 - ↳ Urban Freeways: 2 to 5 miles or between interchanges
 - ↳ Signalized Roads: 0.5 to 2 miles or between intersections with major roads
- ▶ Measurement
 - ↳ Direct: probe vehicle-based, smartphones, fleets
 - ↳ Indirect: detector-based

<http://www.wsdot.wa.gov/accountability/>



Total Delay (*Quality*)

- ▶ Total delay (measured across entire year)
 - ↳ Recurring - Vehicle delays that are repeatable
 - ↳ Non-recurring or Event – Unusual delays
- ▶ Difference between the travel time for a roadway segment and the unconstrained travel time
 - ↳ Vehicle-hours and person-hours
 - ↳ For multiple corridors – delay per mile
 - ↳ *Can also use other target speeds/conditions*





Throughput (*Quality*)

- ▶ Person: People flow on all roadway types under both recurring and nonrecurring traffic conditions (persons/hour)
- ▶ Vehicle: Traffic flow on all roadway types under both recurring and nonrecurring traffic conditions (vehicles/hour)
- ▶ Vehicle-miles of travel (VMT) often used as a throughput measure as well; also an important weighting factor for all measures





Travel Time Index (*Quality*)

- ▶ Normalized comparison of travel time (so, no length)
- ▶ The average time to traverse a section of roadway in a single direction compared to free-flow travel time
 - ↳ Urban Freeways: 2-5 miles or between interchanges
 - ↳ Signalized Roads: 0.5-2 miles or between intersections with major roads
- ▶ Measurement
 - ↳ Direct: probe vehicle-based
 - ↳ Indirect: detector-based

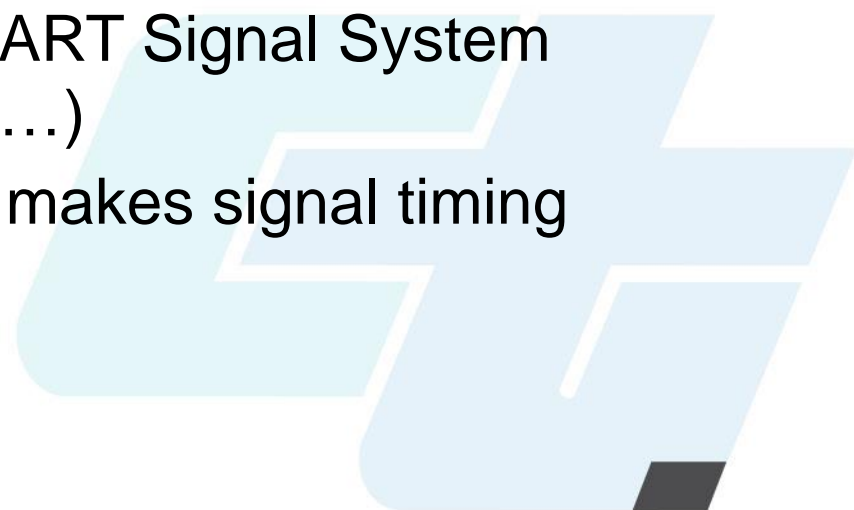
http://www.grta.org/tran_map/2010_Transportation_MAP_Report.pdf





Arterial/Signal System Measures (Activity & Quality)

- ▶ Useful Measures for Arterials and Signal Systems:
 - ↳ Travel Time, Delay, Queue Length, Split Failure, Cycle Failure, Stops, Emissions
- ▶ Research findings:
 - ↳ Purdue: Bluetooth; signal phase and timing information
 - ↳ NCHRP 3-79: Travel times on arterials
 - ↳ University of Minnesota: SMART Signal System
 - ↳ Others (Oregon, Univ of MD...)
- ▶ Ability to visualize performance makes signal timing evaluation less complicated





Incident Management Measures (*Activity & Quality*)

- ▶ Agency operations are most common performance measures (why??)
- ▶ Describe the services performed & *outcomes*
 - ↳ Service patrol vehicles per mile or hours of service provided - most frequent
 - ↳ Location, number and timing of incidents
 - ↳ *Public wants to know >>>> Crashes, delay, travel time reliability*





Freight Measures (*Quality*)

- ▶ Freight Significant Corridors (FHWA)
 - ↳ Partner with ATRI
 - ↳ Average operating speeds (entire Corridor)
 - ↳ Travel time reliability (Buffer Index)
- ▶ Freight throughput
- ▶ Aligning with economic development?
- ▶ Other freight data sets coming (INRIX, UWash, CFIRE)

